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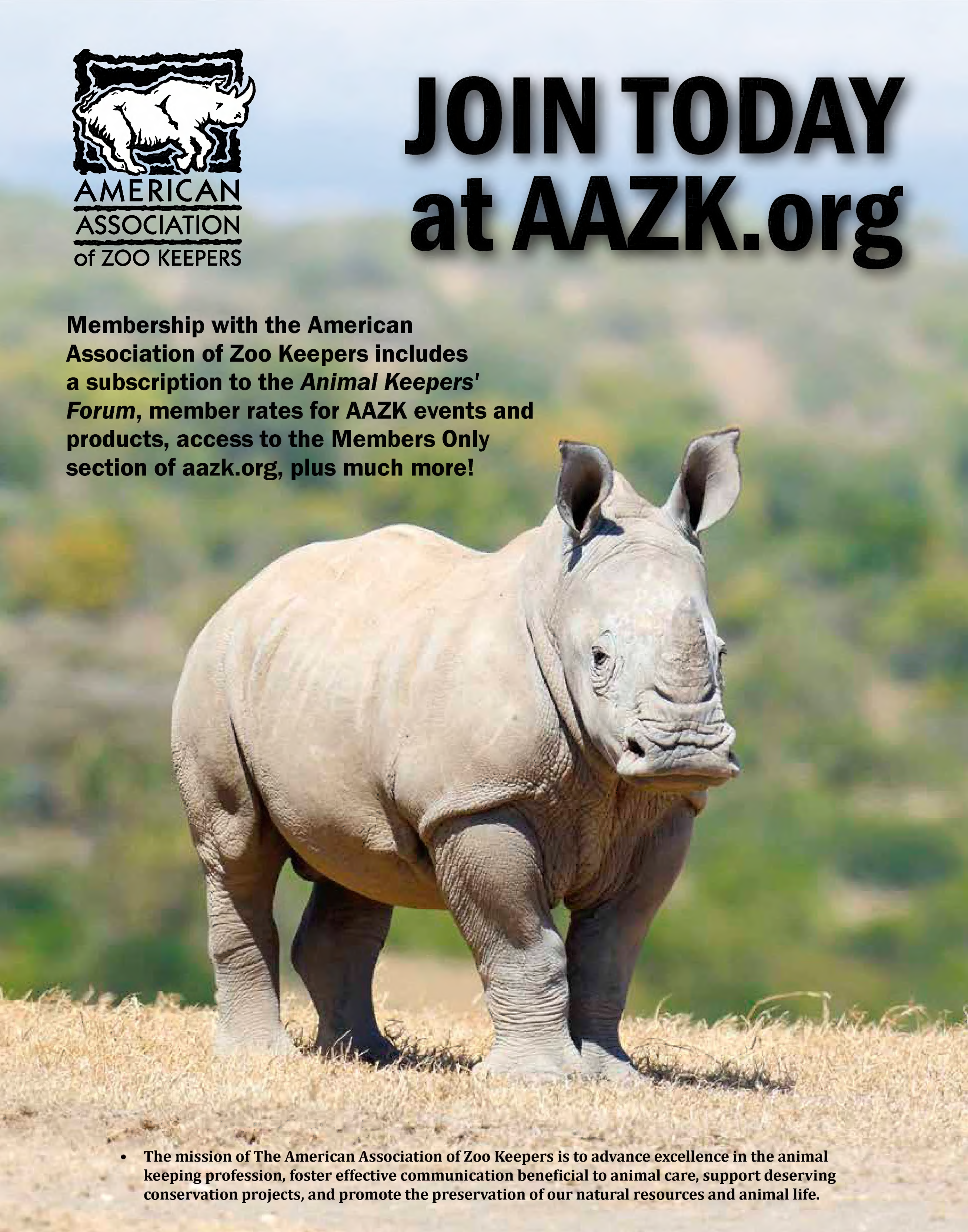

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The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

This month's cover photo comes to us from Emily Mack of Zoo Knoxville, and features Somali wild ass (*Equus africanus somaliensis*). The Somali wild ass is one of three subspecies of African wild ass. Overall, the species is the smallest of the wild equids (horses, asses, and zebras). A typical African wild ass stands about four feet at the shoulder and weighs about 600 pounds.

Somali wild asses are mostly gray in color, with a white belly. They do have one outstanding feature: the horizontal stripes on their legs. With legs like that, it's no surprise these animals are closely related to zebras. All subspecies of the African wild ass (including the Somali wild ass) are critically endangered. Wild populations have declined for a number of reasons. For one thing, some local people have been known to hunt the asses for food and for use in traditional medicine.

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for *AKF*. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

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National Zoo Keeper Week 2020 will continue the promotion with the theme of "It Takes a Zoo: Zoo Keeping Takes Collaboration".

"Why is there a National Zoo Keeper Week? As the need to protect and preserve wildlife and their vanishing habitats continues to increase, the animal care professional's role as educators and conservation ambassadors has become essential."

This is quoted directly from the National Zoo Keeper Week planning packet. And the last word in the quote has never been spotlighted more than it has in 2020 – **ESSENTIAL**. It's a word we've heard a lot in the field during the COVID-19 pandemic. Whether in reference to the disinfection protocols that must now be followed, the tasks that must now take precedent, or the staff that are still required to come into the workplace, essential has become a 'buzzword' with zoos and aquariums. But the work of keepers has always been essential and AAZK and the National Zoo Keeper Week program has been promoting the essential role of animal care professionals since 2007. National Zoo Keeper Week 2020 will continue the promotion with the theme of "It Takes a Zoo: Zoo Keeping Takes Collaboration".

Every keeper knows that teamwork has been an essential requirement in the zooquaria field long before the pandemic. Not only is cooperative work important with teammates, but collaboration with different departments and areas helps us become the best conservationists and keepers that we can. These collaborative endeavors have reached a new level as facilities respond to COVID-19 requiring staff at every level to take on important essential roles in an environment of isolation and increased cleanliness. The human aspects of the job are always important, but the changes to safety and engagement brought on by the pandemic have made their jobs more essential than ever. Departments such as HR, IT, visitor engagement, and education have communicated shifting safety guidelines and maintained virtual connections and institutional support when visitors and staff are unable to interact on-grounds. Without the essential work of these departments, the animal care staff would never be able to perform their duties.

Maintaining the highest standards of animal care and welfare during closures and restrictions has placed challenges before employees that work adjacent to animal care professionals. Commissaries have worked to maintain regular supplies of disinfectants and hard-to-find food items such as bread, vet staff have kept at the forefront of the impact of the virus on animals and maintained medical procedures and observations in an environment of social distancing, and maintenance staff have repaired exhibits and grounds in the absence of visitors. And as always, the essential work of caring for the animals at zoos and aquariums has been ongoing by the dedicated animal keepers.

With National Zoo Keeper Week upon us this year, all AAZK members have essential responsibilities. It is essential that we promote, recognize, and celebrate the challenges that our field has met and overcome during the COVID-19 pandemic. I'm proud to take part in National Zoo Keeper Week every year and I wish an especially hearty Happy NZKW to all keepers in 2020!

Cheers,

Paul

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Siamang Synergy:

Genesis of the decision to hand-raise three siamang infants and their subsequent development toward adulthood

Joanne Luyster, Keeper II (retired)
Jane Anne Franklin, Mammal Curator
Louisville Zoological Garden, Louisville, KY

Introduction and Overview of Siamang Social Structure

Siamangs (*Symphalangus syndactylus*) inhabit the rain forests of Southeast Asia. This largest member of the gibbon family is highly arboreal and mainly frugivourous (Chivers 1977). Siamangs live in highly structured monogamous family groups in which the male takes an active parental role in raising the offspring (Lappan 2008). A pair generally produces offspring every two - three years, and the offspring remain with the natal group until the age of seven or eight, when they approach sexual maturity (Lappan 2008, Gittins and Raemaekers 1980).

Background

Louisville Zoological Garden (LZG) decided to include siamangs, along with orangutans, Sumatran tigers, Malayan tapirs, and babirusa, as part of their innovative Islands exhibit that opened in 1996. The Islands exhibit consists of three outdoor exhibit areas, one indoor "day room" exhibit, and extensive off-exhibit holding areas, subdivided into designated primate, carnivore, and hoofstock sections. Zoo staff rotates animals on and off exhibit throughout the day thereby offering Zoo visitors a dynamic experience.

Infant Zoli with keepr Lee Smathers in PPE. Photo courtesy of Louisville Zoological Garden.

The Zoo acquired 1.0 siamang Ziggy (7 ½ years old) in October 1996 and 0.1 siamang Sue Ann (4 years old) in July 2001, per the Siamang Gibbon SSP recommendation, with the expectation that they would produce offspring. The pair bonded well, and exhibited normal social interactions, with Sue Ann often taking a dominant role over larger, older Ziggy. Although staff observed the pair breeding, no offspring were produced. In 2006, Zoo veterinary staff, with the assistance of consulting gynecologists, conducted an extensive reproductive examination of Sue Ann to ascertain if a physiological component was contributing to her failure to become pregnant. Other than a somewhat irregular cycle, which could have been a factor, no other physical abnormalities were observed. Because sperm was found in Sue Ann's urine, indicating that Ziggy was not aspermatic, staff decided not to conduct a more thorough reproductive assessment on Ziggy at that time. The pair continued to be housed together and was observed breeding.

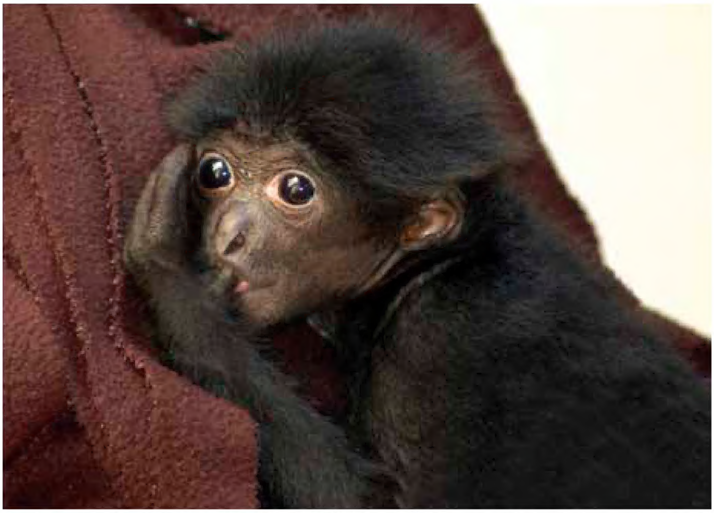
A little over 11 months later, keeper staff arrived the morning of February 20, 2007 to find Sue Ann holding an infant that was clinging to her chest. Staff was able to observe the 1.0 infant, named Zoli, nursing and Sue Ann providing appropriate maternal care, a relief to staff as Sue Ann had been hand-reared and had no exposure to maternal behavior. Sue Ann continued in this manner, and Ziggy provided support to Sue Ann and showed interest in the infant. The pair successfully cared for the infant for approximately six weeks.

Tragedy Strikes

However, on the morning of April 4, 2007, when the infant was six weeks old, staff arrived to discover the adult pair had died in the Islands Day Room, where the family had spent the night. Zoo staff had observed the siamangs around 11 p.m. the previous evening alive and well. Staff found the infant under the female's body, clinging to her. Staff rushed the infant to the Zoo's Animal Health Center for evaluation to determine his condition. Although his temperature was low (35°C, 95°F), Zoli was bright, alert, and hungry, weighing 611 gm. Following guidelines established for other primate infant hand-raising protocols, Zoo staff quickly implemented a dynamic policy for the siamang infant's immediate care. Subsequently, necropsies and extensive research and investigation by veterinary staff, with the assistance of the city medical examiner, determined that the adult siamangs died from acute systemic shock from an extraintestinal pathogenic *Escherichia coli* septicemia.

Onset of Hand-raising Siamang Infant

After the initial shock of losing Ziggy and Sue Ann, staff began accumulating information on how to proceed with hand-raising the infant. Islands Supervisor Jane Anne Franklin contacted the Siamang SSP coordinator for guidelines and input. Although the recommendation was to get the infant into a surrogacy situation, no surrogacy options were immediately available, so staff researched hand-raising efforts at other facilities, including Fort Wayne Children's Zoo and Columbus Zoo, to determine what aspects to include in Louisville Zoo's developing protocol.


Infant Zain on fringed vest. Photo courtesy of Louisville Zoological Garden.

From these protocols, Louisville Zoo staff established these guidelines:

- No diapers; use cloth wrap when holding infant to catch urine, feces
- Caregiver staff to utilize personal protective equipment, including gloves, scrub top and pants, and shoes designated for wear only when with infant and kept in Islands area
- Maintain appropriate temperature in infant's environment
- Monitor infant's temperature
- Provide surrogate stuffed animal and/or blanket for infant to clutch
- Wear black, simulated fur vest when holding infant
- Involve both male and female caregivers in management

On the first day of care, the infant was housed in an incubator, maintained at 26.6°C (80°F), between feedings. Zoli was fed a formula of 75% Enfamil® and 25% Pedialyte® every two to three hours. Staff used a preemie nipple, and after a few fumbling attempts to feed, Zoli was able to nurse successfully. He was also given Clavamox® twice a day. The infant slept for long periods throughout the day and night. The next day he was fed 30 ml Enfamil® every 3-4 hours, Clavamox® twice a day, and Polyvisol® (without iron) once a day.

Supervisor Jane Anne Franklin stayed with Zoli overnight for several nights, but she noted he slept throughout the first night in the incubator, snuggling a stuffed animal. Once it was determined he was able to regulate his temperature, he was moved into a large dog kennel. After a week during which he continued to sleep through the night, the decision was made to leave him overnight with his surrogate bear after his final feeding of the day at 10 p.m. (Note: in retrospect, staff would probably stay with the infant overnight, or rather, around the clock, for an extended period of time. The decision to leave this infant alone was made, in part, because of the behavior and demeanor of this particular infant).

During the day, keeper staff carried Zoli while wearing a black fleece top with strips to simulate siamang fur while doing other tasks.

Zoli's Development

As Zoli progressed, staff implemented bottle increases based on 25% of his body weight. At seven weeks, he was offered mashed banana and browse.

AGE in DAYS	DIET	AMOUNT	FREQUENCY
42	1/2 Pedialyte®, 1/2 Enfamil®	30 ml	2 feedings 2 hours apart
42	1/4 Pedialyte®, 3/4 Enfamil®	30 ml	3 feedings, 3 hours apart
43-51	Enfamil®	30 ml	6 times, 3 hours apart
44	Pedialyte®	15 ml	When woke up fussy
49	Mashed banana, browse		Several times a day
53-61	Transition from Enfamil ® to Enfamil® with iron	36 ml	6 times a day
64	Enfamil® with iron	40 ml	6 times a day
58-78	Banana, apple pieces, baby food, soaked Mazuri® monkey biscuits		Several times a day
69	Enfamil® with iron + water	42 ml	6 times a day/10 cc H2O afterward
74	Enfamil® with iron + water	44 ml	6 times a day/10 cc H2O afterward
78	Add rice cereal to formula		6 times a day/10 cc H2O afterward
79	Enfamil® w/iron + water+ rice cereal	46 ml	6 times a day/10 cc H2O afterward
84	Enfamil® w/iron + water+ rice cereal	56 ml	5 times a day
88	Enfamil® w/iron + water+ rice cereal	60 ml	5 times a day
100	Enfamil® w/iron + water+ rice cereal	63 ml	5 times a day
112	Enfamil® w/iron + water+ rice cereal	66 ml	5 times a day
116	Discontinue rice, add romaine, kale, apple, banana, etc.		5 times a day
120	Enfamil® w/iron	73 ml	5 times a day
129	Enfamil® w/iron	78 ml	5 times a day
181	Enfamil® w/iron	80 ml	4 times a day
347	Enfamil® w/iron	90 ml	3 times a day
519	Enfamil® w/iron	90 ml	2 times a day
628	Enfamil® w/iron	90 ml	Morning only
1020	1/2 juice, 1/2 water	60 ml	Once a day

Zoli feeding chart

Staff continued to weigh him daily. Other foods added to his diet included baby foods such as yams, squash, and green beans, and eventually Mazuri® leaf eater biscuits soaked in water. Staff also offered him Pedialyte® and then tap water after his bottle and between bottle feedings (See Zoli feeding chart).

It became evident early on that Zoli was establishing a bond with keepers. Since he would never be asked to contend with a wild existence, establishing a relationship between keepers and infant was vital to providing the care necessary for Zoli's successful growth and development. This symbiotic relationship enabled Zoli to be a siamang while still allowing keepers to elicit cooperative behavior on his part.

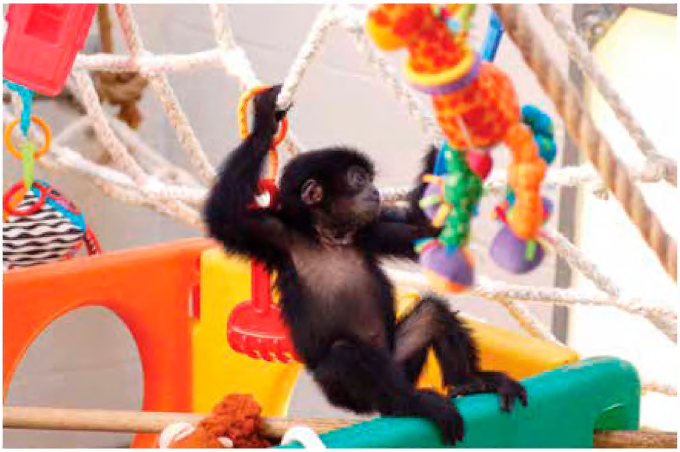
By this time, Zoli was housed in a large dog kennel, equipped with a few toys and a large stuffed gorilla, within a stall in the primate area of Islands off-exhibit holding. Staff slowly introduced various toys and devices to aid in stimulating Zoli to begin to exhibit appropriate behaviors. As he got older, he was exposed to an environment dubbed "Siamang Disneyland."

Arrival of Second Siamang Infant

Throughout this time period, Zoo staff continued to explore surrogacy options. However, when it became clear that no adult surrogate was available, Zoo staff began looking for any companion for Zoli. Because LZG had no other siamangs, a conscious effort was made to expose the infant to his neighboring orangutans. One male, Segundo, was very interested in the infant and purred anytime a keeper carrying Zoli walked past him.

Because exposure to conspecifics is vital for proper socialization (Mootnick 2005), Zoo staff was open to accepting another siamang infant. In July, Zoo staff became aware of a male siamang infant, born May 27 and rejected on Day One by his parents, that was being hand-raised at Albuquerque Zoo. The decision was made to transfer the infant Zain to Louisville to live with Zoli.

On July 12, Zoo staff met Albuquerque Zoo staff in Tulsa OK, picked up Zain and transferred him back to Louisville. Zain had been kept in a basket with a blanket and fed on demand, averaging every two to four hours. He was put on a feeding schedule of every three hours, and Zoo staff worked over a period of several days to acclimate Zain to a schedule of feedings more in line with Zoli's (See Zain feeding chart). Zain



Zoli in "Siamang Disneyland".
Photo courtesy of Louisville Zoological Garden.

was weighed daily, and staff used the same protocols, such as wearing PPE and using the simulated fur vest, when holding the infant. Staff also introduced the two infants in the playroom during the day, and they were housed in adjoining kennels. As such, both infants were considered "in quarantine" until veterinary staff completed all testing on Zain. Staff removed Zain's basket after a few days because he was falling out of it, and he was offered stuffed animals and blankets comparable to Zoli's setup.

Zain had a history of bilateral axillary lymph node enlargement and had been on antibiotics, so staff also took his temperature daily. After a few days, Zain began running a low grade fever (37.2°C, 99°F) and had diarrhea. He behaved normally and was bright and alert. Fecal cultures revealed an infection and he was placed on Clavamox® as well as Benebac® to stabilize his gut flora. Staff also tinkered with his diet offerings and amounts, including adding rice cereal to his bottle. He continued to have gastrointestinal issues off and on, but once he started on solid foods, those issues seemed to mitigate. Although he was offered baby food yams, green beans, and sweet potatoes, he never seemed to like them, but preferred leafy greens, fruits (bananas), and cooked potatoes and cooked sweet potatoes.

Zain's lymph node enlargement persisted off and on for several months; no definite underlying cause was determined and the issue resolved itself.

Two Siamangs

Keepers spent a lot of time with the pair, encouraging activity while making sure no one got into an unsafe situation. Zain did not exhibit the same amount of mobility and agility as Zoli had at the same age. He sometimes became frustrated when he couldn't move to where Zoli was, and he had a habit of expressing his frustration by biting whatever was closest, including keepers! This behavior was discouraged, usually by distracting him with a toy or other object. However, Zain was very interested in watching and mimicking Zoli's behaviors and he slowly became more active, playing with toys and increasing his agility.

All three siamangs on slide, a favorite enrichment item. Photo by Louisville Zoological Garden.

Unlike Zoli, Zain often sucked his thumb, something he had done since arriving in Louisville. This behavior appeared to be similar to that of human infants in that Zain would suck his thumb if unsure or apprehensive, and this seemed to reassure, or "pacify" him. Because of his rather traumatic entry into the world and because he could easily develop another much more deleterious behavior, staff decided to ignore his thumb sucking and concentrate on his physical and social development. To this day, Zain will occasionally suck his thumb.

At first, Zoli seemed a little jealous of Zain and became more needy and clingy with keeper staff. He also made it a point to take away whatever Zain was playing with at the moment. However, after a short period of "terrible twos," Zoli accepted Zain and the two got along well. The "boys" enjoyed interacting with each other, discovering what it means to be "siamang."

Zain feeding chart

AGE in DAYS	DIET	AMOUNT	FREQUENCY
47	Similac®	44 ml	6 feedings 3 hours apart
49	Similac®	48 ml	6 feedings, 3 hours apart
52	Similac®	50 ml	6 feedings, 3 hours apart
53-55	1/2 Similac®, 1/2 Pedialyte®	45 ml	6 feedings, diarrhea issues
55	1/2 Similac®, 1/2 water + rice cereal	45 ml	6 feedings
63	1/2 Similac®, 1/2 water + rice cereal	46 ml	6 times a day
64	1/2 Similac®, 1/2 water + rice cereal	48 ml	6 times a day
78	Banana, apple pieces, baby food, soaked Mazuri® monkey biscuits		Several times a day
80	1/2 Similac®, 1/2 water + rice cereal	56 ml	6 times a day/ Benebac® 2 x day
87	1/2 Similac®, 1/2 water + rice cereal	60 ml	5 times a day/ Benebac® 2 x day
133	1/2 Similac®, 1/2 water + rice cereal	66 ml	6 times a day/10 cc H2O afterward
156	1/2 Similac®, 1/2 water + rice cereal	70 ml	6 times a day/10 cc H2O afterward
180	1/2 Similac®, 1/2 water + rice cereal	75 ml	4 times a day
195	Discontinue Bene bac®		
204	1/2 Similac®, 1/2 water + rice cereal	80 ml	4 times a day
254	1/2 Similac®, 1/2 water + rice cereal	90 ml	4 times a day
343	Running fever, start acetimenophen		3 times a day
430	1/2 Similac®, 1/2 water + rice cereal	90 ml	2 times a day
515	Discontinue rice cereal		
537	1/2 Similac®, 1/2 water	90 ml	Morning only
673-678	Change from Similac® liquid to all Similac® powder	90 ml	Morning only
914	1/2 juice, 1/2 water	90 ml	Once a day

Zoli on first day in outdoor exhibit. Photo courtesy of Louisville Zoological Garden.

Siamang weight chart

Zoli- age in days, weight in grams					
47	720.7	**59**	818.4	**125**	1346.4
48	711	**60**	806.2	**150**	1516
49	724.8	**67**	868.1	**175**	1741
50	761.6	**74**	917.2	**200**	1913.1
53	758.8	**81**	995.5	**225**	2126
54	750	**88**	1032	**250**	2365
55	783	**95**	1095	**275**	2522
56	798	**102**	1150	**300**	2736
57	792	**109**	1206.8	**325**	2895
58	806	**120**	1325	**350**	3029
				365	3120

Zain - ages in days, weight in grams					
48	1001.5	**61**	1081.8	**100**	1344
49	989	**62**	1100	**125**	1507
50	999.4	**63**	1123	**150**	1650
51	1053.4	**64**	1100	**175**	1825
52	1028	**65**	1112.6	**200**	2025
55	1015	**66**	1130	**225**	2212
56	1042.4	**67**	1154	**250**	2379
57	1021.8	**68**	1159	**275**	2407
58	1085.9	**70**	1198	**300**	2512
59	1063	**80**	1210	**325**	2756
60	1047	**90**	1309.6	**365**	2761

Sungai - age in months, weight in grams					
14	3402	**21**	4767	**24**	5190
				28	5960

And Sungai Makes Three

At the same time Louisville Zoo pursued obtaining Zain, San Francisco Zoo reached out to offer 0.1 siamang Sungai as a companion for Zoli. Sungai, a full sibling of Zain, was born August 8, 2006 at Albuquerque Zoo. Rejected by her mother, Sungai was sent to the Houston Zoo in an attempt to place her in a surrogacy situation with the Zoo's adult siamang pair and their two-year-old offspring. Houston Zoo cared for the infant, but efforts to introduce her to the group were unsuccessful. Although the introductions went well at first, all three siamangs showing interest in her, they then ignored her and her vocalizations. Later in the day the adults attacked the infant and although she was physically fine, the decision was made to discontinue her introductions to the group.

Sungai was then transferred to the San Francisco Zoo in mid-February of 2007 with the goal of having the San Francisco Zoo's adult pair serve as a surrogate family group for the infant. San Francisco Zoo staff placed the adult siamangs off-exhibit, essentially placing them in quarantine along with the infant. Zoo staff spent seven weeks introducing Sungai to the pair through a protective barrier before attempting an introduction to the female. The first introduction to the female lasted only a few minutes because the female was obviously stressed and the infant was constantly vocalizing. A second attempt six weeks later lasted two days; the female seemed interested but Sungai threatened the female whenever she was approached. The female's patience waned on the second day and she began showing signs of aggression. Not wanting to subject Sungai to another negative adult siamang experience, Zoo staff decided to discontinue reintroductions. The staff then continued to care for Sungai 24 hours a day. Not surprising, considering her past experiences, Sungai also exhibited thumb sucking when she felt apprehensive.

Wanting to integrate Sungai into a relatively "normal" environment, both San Francisco and Louisville, as well as the Siamang SSP coordinators, decided it was best for Sungai to go to LZG to be with the two male youngsters. Sungai arrived in Louisville in August 2007. Once again all three siamangs were considered to be in quarantine.

Although Sungai was already over one year of age, because San Francisco Zoo staff had been staying with Sungai 24 hours a day, LZG staff initially stayed with her overnight. Her first night was a restless one, but she ate well (formula and vegetables). The next morning she was introduced to Zoli and Zain. She interacted with Zoli; no overly aggressive actions occurred. Staff also left Sungai by herself off and on during the day. Sungai was housed in a stall adjoining the other youngsters. Within two days of arrival she was sleeping through the night, curled up in a blanket-lined milk crate, which was attached to the front of her stall. Staff discontinued 24 hour care after a week, but continued to return to feed all three infants late evening, around 10 p.m (See feeding charts for all three siamangs)

Meanwhile, Zoli and Zain had established a very close relationship prior to Sungai's arrival. They often performed a bonding "hug," which seemed to be a reassuring and comforting behavior, whenever one of them appeared stressed. Both males, however, paid close attention to the older Sungai, who was a much more agile and accomplished climber. After carefully studying her movements and behaviors, Zoli and Zain were often observed attempting to mimic Sungai's actions, suggesting that this peer interaction helped stimulate the growth and development of the younger siamangs.

MONTHS	DIET	AMT	FREQUENCY
12.5	Enfamil® with low iron	60 ml	Twice a day
From 12.5 on	Browse, kale, spinach,, collards, apple,banana, Mazuri® monkey biscuits, etc.		Several times a day
14	Change to Enfamil® with iron	60 ml	Twice a day
27		60 ml	Once a day

Sungai feeding chart

Once they were totally integrated, the three spent their days together in the playroom, accompanied periodically by staff members, before being returned to their respective night enclosures. In order to expand their environmental experiences, they also began spending some time in the dayroom, always accompanied by at least one staff member.

New Adventures

In October of 2007, the three youngsters, each held by a staff member, made their first foray outside to one of the three outdoor habitats in the Islands area in order to gain another new experience. Although slightly intimidated at first, the three quickly grew to enjoy exploring this new world. Both indoor and outdoor areas were propped with various enrichment items.

In July 2010, when Zain and Zoli were three-years-old, their crates were removed from their night quarters and the two slept on shelves in their stall. Meanwhile, Sungai discontinued sleeping in her milk crate and she also slept on a shelf in her stall. A month later all three were housed in the adjoining stalls, either together or, at times, separated.

Sungai arrives.

As the siamangs aged, they began to show unwanted behaviors toward staff, particularly if preferred food items were involved. In addition, they were sometimes suspicious of new staff members attempting to integrate into the routine of caring for the youngsters. Staff implemented new protocols, including no preferred food items in enclosures when staff and siamangs were together and distracting siamangs when a staff person was entering/ exiting an enclosure. These protocols reduced, but did not totally eliminate, the unwanted behaviors.

In December of 2009, Islands staff instituted an operant conditioning training program with the siamangs. At first the youngsters were whistle-fed, but they soon progressed to other behaviors including stationing, shifting, “sit,” “come here,” and presentation of various body parts.

Utilizing the established training behaviors was vital in dealing with behaviors that developed as the siamangs grew. For instance, Zain began to instigate adverse behaviors between the siamangs, usually in response to food and/or browse feedings. In order to address this issue, staff established a policy where one person would call Zain to a separate area and reward him by feeding him there, while another one or more staff members fed Zoli and Sungai. Being able to station the siamangs in different areas, as well as bridge their movement with a whistle, helped to diffuse this behavior.

As the three grew, they spent more time outdoors and in the dayroom, exploring and interacting with their environment, either alone or with an Islands staff or other Zoo staff designated as “siamang surrogate sitters.” Islands staff made sure that the surrogates provided the siamangs with a “multi-cultural” experience by inviting diverse Zoo staff to participate in caring for, and observing, the youngsters. The siamangs accepted sitters that were male, female, bearded, bald, young, older, tall, short, and various ethnicities.

Staff observed the three performing appropriate natural behaviors such as dipping their hands into the exhibit stream and drinking the water drops, climbing to the top of the exhibit and brachiating across the mesh, grooming each other (and occasionally the staff) foraging for browse, and vocalizing three part harmony "songs."

Puberty

When the siamangs reached their "pre-puberty" years and their adult canine teeth came in, staff discontinued going into an enclosure or exhibit with the siamangs, for the safety of staff. As the siamangs approached maturity, the three were more apt to become embroiled in disputes over food, toys, or territory. Because they were in an abnormal social situation (two males, one female), Zoo staff tried to find a suitable place to send Zain, as Zoli and Sungai were, at the time, deemed an appropriate pairing. When the Zoo was unable to find a place for Zain, staff restructured the housing arrangements, instituting a fission/fusion concept whereby no more than two siamangs were housed together. As they grew, the three demonstrated appropriate pro-social siamang behavior.

The siamangs continued to participate in the operant conditioning training program, and to interact with staff in a protected contact environment. Eventually the three seemed to prefer socializing with each other rather than with staff.

Postscript

In 2017, the Siamang SSP decided on mate pairings for all three siamangs. LZG staff, in agreement with Siamang SSP Coordinators, thought that Sungai, because of her past experiences, would have a more difficult time being introduced to a new adult male siamang and would benefit from staying at LZG, where she felt more secure. Therefore her new mate should come to LZG. Zoli and Zain, determined to be more adaptable to new situations, were sent to other institutions. After Zain was shipped to West Palm Beach Zoo and Zoli was driven to Lee Richardson Zoo, Darwin arrived from Gladys Porter Zoo as Sungai's new mate.

Acknowledgements

The authors would like to thank the many, many people involved in this successful outcome. First, Islands staff Lee Smathers, Day Gardner, Jill Katka, Tracy Parke, and Misty Young; Zoo veterinary staff especially Roy Burns, DVM, Zoli Gyimesi, DVM, and Virginia Crossett, RVT; Assistant Mammal Curator Candy McMahan; reproduction specialists Dr. James Forrester, OB-GYN, and sonographer Debby Wenger; county coroner/pathologist Dr. Barbara Weakley-Jones; and last, but not least, all the Zoo staff who provided countless hours of care as "siamang surrogate sitters."

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The siamangs continued to participate in the operant conditioning training program, and to interact with staff in a protected contact environment.

Siamang See, Siamang Do: Anecdotal observations of juvenile siamang development and behavior by a siamang surrogate sitter

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Louisville Zoological Garden
Louisville, KY

Background

On February 20, 2007, the Louisville Zoological Garden (LZG) welcomed the birth of 1.0 siamang (*Symphalangus syndactylus*) Zoli to 1.0 Ziggy and 0.1 Sue Ann, who were housed in the Islands area of the Zoo. Ziggy and Sue Ann proved to be excellent parents, even though Sue Ann had been hand-raised. All was going well until disaster struck; on the morning of April 4, 2007, Islands staff arrived to find both parents dead from what was later determined to be a systemic E. coli septicemia of unknown origin. Infant Zoli was rushed to the Animal Health Center, where he was treated for hypothermia and dehydration. Once he was stabilized, Islands staff then began the task of hand-raising Zoli. Unable to find an adult siamang surrogate for Zoli, Zoo staff and the Siamang SSP, concerned that Zoli needed to be exposed to conspecifics, recommended that LZG look for and accept other siamang juveniles to be raised in concert with Zoli.

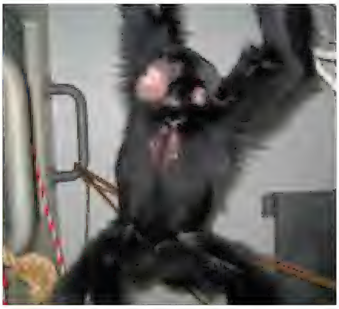
Zain and Zoli embracing. Photo by Jill Katka.

When Zoli was six-months-old, three-month-old Zain (1.0), having been rejected by his parents, arrived from Albuquerque Zoo. Shortly thereafter, one-year-old Sungai (0.1) arrived. Sungai, a full sibling of Zain, had been sent to two other zoos for surrogacy efforts that failed, so she was being hand-raised by staff at San Francisco Zoo. Islands staff provided the bulk of care for the three youngsters, but in order to relieve the staff and expose the siamangs to a diverse cross section of people, Islands supervisor Jane Anne Franklin invited Zoo staff of different ages, ethnicities, and genders to spend time tending to Zoli, Zain, and Sungai. I was fortunate enough to be a part the group referred to as "siamang surrogate sitters." For more than four years during most work days I spent an hour or more with the siamangs.

LZG found little published data on infant and juvenile siamang behavior, and none of the information they unearthed dealt with unrelated orphan siamang youngsters being raised in a quasi-family group. In the course of my spending time with the siamangs, I kept a journal documenting their behaviors, development, and actions. This paper chronicles my observations.

At first the three siamangs spent the day in a super-propped two-story stall, with various ropes, toys, cargo net, etc., dubbed "Siamang Disneyland." They

Zain wary of exhibit wildlife. Photo by Jill Katka.



"Blind" Zoli. Photo by Jill Katka.

Sungai and Zain with author. Photo courtesy of Louisville Zoological Garden

later progressed to the three-story dayroom, which included props for orangutans as well as items added for the siamangs. Finally, the siamangs were given access to one of three outdoor mesh enclosed habitats, which included plants, rock walls, water features, and climbing structures.

Year One

The first year, the younger siamangs intently watched their "senior" cohort and attempted to copy the behavior or activity. For example, Zoli watched Sungai climb the cargo net support rope all the way to the ceiling, then he would tentatively follow suit, although on occasion Sungai would shake the rope to discourage him. Likewise, Zain observed Zoli climbing and maneuvering around the siamang play land, and would attempt to replicate Zoli's actions. Zain arrived at LZG rather weak and unable to grasp well or cling onto the black vests worn by the surrogates, but he progressed by imitating Zoli and was able to maneuver fairly well as his strength increased.

The most interesting interaction between siamangs took place in the play land stall. Sungai and Zoli were running around playing "tag." They ended up on the top of the cargo net, Sungai on the upper left corner, Zoli on the right corner. They stared intently at each other, Zoli started shaking the ropes hard, and then Sungai followed suit. As they stared at each other, close-mouthed, shaking ropes, Zain began to notice their behavior. Zain became very agitated, climbed up onto the cargo net, and made a "whoop" vocalization, his air sac inflating. The other two paid no attention to him. Zain climbed back down to me, vocalized again and inflated his throat sac. He then turned and climbed up next to Zoli, putting his arms around Zoli. The two squatted on the cargo net and embraced, placing their faces against each other. After a few seconds both turned and stared at Sungai, who took off to the other side of the stall. Zain left and climbed down, but Zoli continued to stare at Sungai, so Zain climbed back up to Zoli. The two again embraced and pressed their faces together, after which all three youngsters dispersed to other areas of the stall. The issue was defused.

In a somewhat similar interaction, while in the dayroom, Zain began scuttling across the floor while vocalizing. Zoli reached out and pulled Zain to him. While the two faced each other, Zain lowered his head, and Zoli put his open mouth on top of Zain's head. This behavior seemed to have a calming effect of Zain.

> *The first year, the younger siamangs intently watched their "senior" cohort and attempted to copy the behavior or activity.*

On other occasions Zoli and Zain would swing on ropes, hoot, hug each other and touch faces, even when they appeared to be playing contentedly. Face touching occurred not only between siamangs; at times the siamangs also would touch faces with staff members. Occasionally Zain would swing by on a rope, reach over and hug me, then swing away, all the while hooting. He could easily repeat this activity over and over. Interestingly, when I once replicated Zain's hoot while describing it to another staff member, Zoli hurried over, put his face against mine, and put his arms around my neck. All three would cuddle up with staff, sometimes when they were tired or cold, but other times it seemed just for a little comfort.

One behavior of Zoli's emerged when I happened to blow on his face. He positioned himself so that when I blew on his face he opened his mouth as if "catching" the air. He also started doing this behavior in front of air vents, and he would also engage in this behavior when swinging on ropes. Once, while lying exhausted in my lap after an active day in an outdoor habitat, whenever a breeze would blow, Zoli would lift his head, "catch the wind," and then lay his head back down.

All three siamangs exhibited a behavior that has been observed in other apes; that is, they would play "blind man" by holding their arms out to their sides and stumbling around with their eyes squeezed shut. Zoli often incorporated this routine with somersaulting; he would somersault, stand up "blind," and navigate by touch. Sungai would execute the same behavior but included wobbling her head, which gained her the nickname of "Bobble Head Siamang."

One behavior shared by Sungai and Zain was thumb sucking. Both siamangs had been rejected by their parents and therefore had never nursed, which might have played a role in their behavior. Zoli, who had been parent-reared for the first six weeks of his life, did not suck his thumb except for a few times immediately after Zain arrived when Zoli seemed to be imitating Zain. Oddly, once when Zain wasn't feeling well (feverish, lethargic, cranky, and clingy), Zoli came over to lay by Zain. Zain stuck his thumb in Zoli's mouth and Zoli sucked Zain's thumb. This was an extreme example of how deferential Zoli could be towards Zain when Zain was sick.

Negotiating the Lixit® water source in the dayroom was a challenge for the young siamangs, but Sungai, however, was tall enough to access it and get a drink without getting all wet. At first the boys were barely tall enough to reach it. When Zoli would activate it, water would run down his face and into his nose, causing him to shake his head vigorously. Zain would pull himself up on the Lixit®, turning it on, and he and Zoli would stare at the stream of water running down the wall. Zain then figured out that if he hung from a rope in front of the Lixit®, he could activate it and get a drink. It took Zoli a bit longer to master the Lixit®.

At this young age, the siamangs, when frustrated or mad, would not only bite each other but also try to bite staff. To discourage this behavior, if a siamang tried to bite a staff member, the staff member would say a stern "No!" and pull on a hunk of their hair, something that parental siamangs would have done. This type of reprimand was demonstrated once among the siamangs when Sungai was really harassing Zoli. Finding that his open-mouth threat gesture did not dissuade her, Zoli finally reached over, grabbed a hunk of her hair, and gave it a hard yank. Zoli received the same open-mouthed expression of indignation that we received when doling out this form of chastisement. However, it proved effective, as Sungai quit aggravating Zoli.

Year Two

As the siamangs grew and became more agile, their forms of play became more imaginative. On one occasion the straw had been removed from a portion of the dayroom floor. Sungai was immediately drawn to the bare concrete floor and proceeded to spend half an hour running and then sliding on her chest and belly across the floor. She would extend her arms in front of her, stick her rear end up in the air, and glide across the floor. Eventually all three siamangs seemed to delight in sliding across any bare surface, often, it seemed, trying to outdo the others' style and form.

Mr. Z's Salon. Photo by Jill Katka.

Sungai also embarked on more adventuresome climbing expeditions, including climbing up a tree structure in the outdoor habitat all the way to the top mesh and then brachiating across the exhibit to the side mesh. The boys continued to observe her and also expanded their climbing repertoire to include scaling rock ledges and climbing on the side mesh, where they could munch on bamboo shoots.

The siamangs also continued to play "blind man," "tag," and to perform somersaults, occasionally all at the same time. When exhausted, they would come to lay across my lap, as if they were in a recliner. From time to time a youngster would somersault into my lap, rest awhile, then somersault out and scamper away to resume playing. Their adventuresome nature led the youngsters to consume various items discovered in their habitat. All three used to pick up, chew on, and swallow small rocks. (Although routine physical examination x-rays revealed rocks in various parts of their gastrointestinal tracts, this never seemed to cause a problem.) The siamangs also liked to dine on moths they found in the dayroom mulch, as well as browse on clover, grass, and bamboo. One potentially disastrous incident occurred when Zain was observed eating mushrooms in the outdoor habitat. Unable to immediately identify the mushrooms, Poison Control advised staff to administer activated charcoal to all three siamangs. Staff mixed the activated charcoal powder with yogurt and sweet potato, but administering it turned out to be a rodeo. All involved in this endeavor bore the black stains to prove it! Fortunately the mushrooms were later identified as being non-poisonous.

Although Zoli was the one usually being chased in episodes of "tag," something he often instigated, one afternoon he was hotly pursuing Zain. Zain finally stopped, faced Zoli, and fussed at him in a squeaky voice. The two embraced and the chase was over. Yet even at this age, Zain began exhibiting dominance behaviors over Sungai, whether it be in response to food, toys, or attention from caregivers. We usually let the siamangs sort it out amongst themselves unless their behavior became excessively aggressive. Of the two males, Zain would instigate confrontation; Zoli would placate whomever. When a new staff member or sitter entered the enclosure and was playing with Sungai, if Sungai started making squeaky noises, both Zain and Zoli would rush over and try to bite the person, as if protecting Sungai.

When a new enrichment item, a yellow plastic slide, arrived, it quickly became a favorite addition to the siamangs' environment. All three youngsters would climb up and whoosh down on their stomachs, backs, or sitting upright. The siamangs might perform this activity facing forward or facing backward in any of these positions. The slide was moved between the dayroom and an outside habitat but continued to be a highlight wherever it appeared. For awhile, when Zoli would climb to the top of the slide, Zain would position himself at the bottom of the slide. Undaunted, Zoli would slide down and instead of bumping into Zain, Zoli would leap frog over him.

Being in the outdoor habitat exposed the siamangs to various forms of wildlife. One resident, an industrious chipmunk, sparked an alliance between Zoli and Zain when they spotted it running across the yard. The two came together, put their arms on each other's shoulders, walked toward and confronted the "intruder," which then ran outside the enclosure. On another occasion when they were playing on the rock ledge, they saw a chipmunk and pursued it as it ran along the rock wall toward the mesh and freedom. However, when the boys got too close to the chipmunk, it turned around and moved toward them. Zain and Zoli stopped in their tracks and flattened themselves up against the mesh. The chipmunk then turned around and exited out the mesh, at which point the siamangs felt safe enough to continue their pursuit.

The siamangs found new activities to occupy their days. Zain established a new favorite activity by hanging from a suspended rope, making the rope swing in circles, then laying flat as if he were an airplane, "flying" just above the ground. Zoli started climbing straight up a fire hose to the top of the dayroom, touching the top connecting link, then sliding straight down to the ground. Zoli would also climb along connected sections of fire hose, and slide down wherever there was an incline along the hose. He then progressed to climbing to the top mesh, hanging for a few seconds, and then dropping to a fire hose or cargo net several stories below. Zoli also would somersault across the cargo net, at times falling through one of the net's openings to the floor below. After such an event Zoli would appear to laugh, pick himself up, and be ready to go again.

The three siamangs exhibited a type of fission/fusion relationship with each other. Although Zain and Zoli were very close, forming alliances to thwart invading chipmunks or to co-opt food or toys from Sungai, on several occasions Sungai and Zoli would sit together. Zoli might groom Sungai, or she might put her arm around his waist and he would put his head on her shoulder. During some of these sessions Zain would be very clingy, insisting on being held and snuggled by a surrogate sitter. At other times Zain would seem to exert his independence, not relying on Zoli or sitters for succor.

All three youngsters were attuned to our voices and vocal inflections. One day when a staff member was talking rather animatedly, Zain started "hooting." Every time she stopped talking, he stopped hooting. Every time she talked, he hooted, his throat sac inflating. It was some time before he settled down. We speculated that the siamangs may have considered loud voices as a human variation of "singing," and they often decided to join in the chorus. On another occasion, I told Zoli it was time for me to leave. He came over to me, looked into my eyes, and held out his hand. I shook his hand, said goodbye, after which he returned to playing.

Year Three

At the beginning of my third year as a siamang surrogate sitter, I took a trip and was away from the Zoo for 16 days. Upon my return I wondered how I would be received by the siamangs. However, when I entered the habitat, all three siamangs came running toward me, vocalizing. Zain ran up a tree branch and literally launched himself onto me. Zoli reached up, took my hand, and "guided" me to a rock where I could sit and be accessible to all three youngsters. We were quickly back to status quo.

Zoli emerged as the consummate groomer of the three youngsters. Zain took advantage of Zoli's grooming sprees by throwing himself down in front of Zoli to solicit a grooming event. When Zoli seemed to be finished with Zain's back, Zain would flip over and present his belly for grooming. While Zoli often groomed Zain or Sungai, he seemed to relish grooming me. He might sit on my shoulders or position himself behind my head and proceed to groom my hair, perhaps attracted to the silver streaks he found there? I dubbed it a visit to Mr. Z's Salon, a play on the name of a local hair salon. My appearance

Zain on slide. Photo by Jill Katka.

Zoli performing his Cirque de Siamang routine. Photo by Jill Katka.

after one of these sessions was often met with finger pointing and guffaws from Islands staff, but they soon became used to my tousled hairdo as "normal." In time Zoli, as well as the other two siamangs, solicited grooming from me, vying for the coveted lap position, the preeminent location for a grooming session. Sometimes Zoli would groom me while I was grooming Zain. On one occasion, Zoli was sitting above me grooming me, and Sungai, who was sitting in my lap, joined him in grooming me. Not to be left out, Zain, who was sitting beside me, decided to participate as well so that three sets of siamang fingers were combing through my hair.

These grooming sessions often dissolved into solicitations to be tickled, especially on the back of their necks, an attention all three siamangs were fond of receiving. They would laugh and wriggle away, only to return for more tickling. Though every once in awhile, as they got older, the siamang being groomed did not want to share his/her experience and would open-mouth threaten any interlopers who dared approach.

Interestingly, the siamangs were very responsive to my warnings of potential "dangers." At one point a large spider appeared in the grass. When Zain reached for it, I said "No, no!" He drew his arm back and jumped into my lap. Although he ventured out a few times to observe the "danger," he did not try to pick up the spider and would return to the "safety" of my lap. On another occasion, a hornet was chasing/harassing the siamangs. It buzzed around Zain, who took cover under my leg. It then pursued Zoli; I told Zoli, "Be careful!" and he took off across the yard, over the creek, and onto a high branch on the island. The hornet then turned its attention back to Zain (and me), eventually stinging me in the face. It then proceeded to hound Sungai, but I was able to "dispatch" it. Zain avoided the area of the yard where the "corpse" was located for the rest of the afternoon.

As their physical abilities developed, the siamangs continued to display a myriad of acrobatic feats, especially brachiating exploits, such as mesh walking across habitats, or somersaulting and balance walking on fire hoses. We referred to these activities as Cirque du Siamang. One day it might be somersaulting as a means of navigating across the day room, including somersaulting over to a person, scuttling under their leg "bridge" before somersaulting out the other side and scurrying away. Another day it might be "break dance" sliding on bare floors, spinning and ending up in improbable poses. On yet another day, aerial feats reigned. Zoli was the virtuoso of such exploits, giving him the title of the "Amazing Ischial Callosity Boy." He might balance himself on a big Boomer Ball®, or swing between fire hoses and poles, back flipping himself onto a metal step. Zoli zoomed around the dayroom, swinging from object to object, as if to see how fast he could go. Zoli would also perform flips in the air while brachiating from place to place. He not only flipped head over heels but also rotated left to right, then gracefully grasped the next fire hose feature in his circus act. This routine would then be followed by Zoli plopping himself onto an elevated fire hose and walking across it as if to demonstrate his tightrope capabilities. On one occasion both he and Zain were tearing around the day room, and as they approached each other Zain leapt at Zoli. Zoli caught Zain's hand and swung him to a nearby pole, to complete their version of the Flying Wallendas act.

The "graduation exam" for all three youngsters turned out to be an exhilarating (for them) and heart stopping (for me) exploit. Each siamang, at around age two, would maneuver to the top of the mesh in the dayroom and assess the surrounding area while he/she hung three stories above the floor. The daredevil would then drop to the ground, their momentum slowed by grabbing onto fire hoses, poles, and ropes on the way down. Once on the ground, the accomplished acrobat would get up and nonchalantly walk away as if it were no big deal.

In his "need for speed" while zooming around the dayroom, swinging from object to object, Zoli seemed unable, or unwilling, to stop and would run into one of the siamangs. I was, unfortunately, the recipient of this behavior on one occasion. As I was walking over to sit down, Zoli came flying from the opposite direction and body slammed me in the face. Although I did not develop the expected bloody nose or black eye, my face was swollen and sore for days. Since this type of activity occurred on a regular basis between the siamangs, it underscored the toughness and resiliency of these youngsters.

Periodically some of the siamangs' play behaviors would become aggressive. In his solicitations to play, Zoli would slap Sungai on the head over and over and yank on her hair, her open-mouth threat gestures no deterrent to his behaviors. One of Zain's favorite activities was climbing into and out of pillowcases or wrapping himself up in sheets then thrashing or spinning around. Once Zain was repeatedly somersaulting into a pillowcase, then popping up and wiggling himself out. Sungai observed this behavior and the next time Zain entered the pillowcase head first, Sungai jumped on him. Zain rolled around fighting to get out, but Sungai had him pinned. He eventually quieted down and lay still, and Sungai seemed to tire of the game and left, whereby Zain was able to extricate himself from the pillowcase. Obviously Zain was not too "traumatized" by the event as he later continued to play with/in the pillowcase.

One afternoon Zoli took a rubber duck up to an elevated level in the dayroom where he proceeded to clinch it in his teeth and shake his head vigorously from side to side. He then lay on his back and pawed at the toy with his hands and feet. He sat up, and then repeated this activity numerous times, before ultimately knocking the duck to the ground.

Occasional glimpses of the three youngsters exerting their independence continued to emerge. The siamangs might refuse to leave the dayroom to go to their night quarters on a day they decided they were not done playing. Their balking at leaving the dayroom was accompanied by a lot of vocalizing, though they eventually would acquiesce. The siamangs were becoming more aware of their surroundings and other inhabitants of their environment as well. When Zoli was able to see a Malayan tapir in an adjoining habitat, he seemed very concerned, watching the tapir from various locations, always from a high vantage point. This concern was even greater when one of the siamangs caught sight of a Sumatran tiger in an adjoining habitat. In another instance, when three geese flew over, honking loudly, Sungai hooted and ducked under a branch. On another occasion Zoli spent time playing peek-a-boo with a visitor who was outside the dayroom. A man was watching Zoli and Zoli scooted up a fire hose until he was hidden from the man. The man peeked around the corner until he saw Zoli and then retreated. Zoli would then scoot down the fire hose until he saw the man, and then he would scoot back up the fire hose until he was once again hidden. They repeated this game several times.

The one natural element in their environment the siamangs had no curiosity about was rain. Whenever they happened to be outside in the rain, they would try to hide behind my legs, under branches, and eventually in recesses in the rock formations in the habitat. They also showed some signs of allergic reactions during high pollen count days such as runny noses and red, squinty eyes.

In their interactions with me, each siamang developed individual behaviors. Sungai delighted in untying my shoe laces. She would often do this surreptitiously when the siamangs were grazing on clover near my feet. Sungai was also very partial to piggy back rides. Additionally she liked to approach me from behind, somersault over my head, and land in my lap. Besides operating Mr. Z's Salon, Zoli spent a lot of time snuggling in my lap. His unique behavior was to position himself in front of my face and gaze intently into my eyes for minutes on end. Zoli also liked to come up behind me, put his arms around my neck and lay his head on top of my head. Zain played the part of the youngest by making peeping noises (Chee chee!) in order to garner attention and snuggle time. This behavior also earned him the title of "Chee Chee Man." He and I would "chee chee" at each other, engaging in our own private conversations. In addition, Zain was extremely fond of being tickled. Oddly, all three would sometimes put their mouths on my nose, a behavior which I interpreted as a bonding gesture.

By this time Sungai was beginning to perfect her singing voice and sometimes Zoli would join in the vocalizing. Although their singing was not as loud as adult siamang vocalizations, it still annoyed the resident orangutans who would grimace and stick their fingers in their ears.

From the onset of the surrogacy program, each siamang's interactions with, and behavior toward, staff varied from person to person. In some cases a deeper bond developed between a particular siamang and caregiver and this preference was readily perceptible in the siamang's behavior (e.g., vocalizations, snuggling, solicitations to be carried, one-on-one time, and enthusiastic response to training sessions and commands). In other cases, a strong bond between a particular siamang and caregiver did not form, and the siamang would be more apt to exhibit undesirable behaviors toward that person (e.g., biting, slapping, hair pulling, aloofness, and recalcitrance to training sessions and commands). As they matured, the siamangs seemed unwilling to accept some new people into their environment. For example, they were suspicious of a new staff member who was attempting to integrate into the routine, and she received a warning nip on several occasions. Sungai was particularly prone to try to bite when preferred food items were involved when offered by certain caregivers. Staff implemented new management protocols to address

From the onset of the surrogacy program, each siamang's interactions with, and behavior toward, staff varied from person to person.

these issues. These protocols included having another person call the siamangs to another part of the enclosure when a staff member was entering or exiting the enclosure to deter the siamangs from jumping on or otherwise harassing that person. In addition, staff no longer brought preferred food items into the enclosure; instead, staff fed preferred food items to the siamangs through the enclosure mesh, which provided a protective barrier. These new protocols reduced, but did not entirely eliminate, these behaviors.

Year Four

By now the siamangs were navigating the Islands area chute system to access the habitats and dayroom from the night quarters. Their demeanor alternated between being clingy and being aloof. Fewer staff members spent time with the siamangs so they were often vying for snuggles and lap time when I was with them. Zoli might spend a large part of my visit sitting on my shoulder, emulating a pirate's parrot. All of the siamangs solicited grooming and tickling sessions. When they were in the mood, I could easily examine their eyes, ears, and other body parts. One day Zain somehow got a piece of grass in his eye. As he lay quietly immobile in my lap, I was able to hold his eye open and remove the grass particle, even though it took multiple attempts before I was successful.

On the aloof days, Zoli might find a fire hose and lay on his side in what I called his "GQ pose." At other times the siamangs would be off exploring, grazing, or playing alone or with each other. Zoli developed a new past time: he would position himself in tall grass, sweep his arm through the grass, and then stop when a bug landed on his arm, allowing him to quickly catch and eat the "prey." He would repeat this activity for long periods of time.

On one day of exploration in the dayroom, Sungai found a walnut that had been left by the orangutans. She tried for awhile to crack it open but eventually gave up and threw it to the ground. Next Zoli proceeded to pick it up; he, too, tried unsuccessfully to crack the walnut, and threw it down. Zain grabbed it and ran to the other side of the dayroom where, after a few seconds, I heard a crack! Zain sauntered over, eating the walnut with relish, refusing to share any with his cohorts.

Zoli engaged in a few other unique behaviors. While in a stall, he would approach a rope attached between the ceiling skylight and the front stall mesh. He would grab the rope at the top with his feet, hang upside down with arms dangling, and slide down the rope, spinning and twisting as he moved. He also utilized a rope attached to the skylight at one end and attached to a fire hose at the other for his spinning games. However, one day he somehow managed to get the rope looped around his waist. He became upset when he was unable to escape the rope because when he pulled on both ends of the rope, it tightened around him. He thrashed around until he was finally able to extricate himself from the self-imposed trap. After this episode, staff removed the offending rope from the stall to preclude any further such incidents.

Another behavior Zoli performed occurred on dry winter days in the dayroom and involved rapidly rubbing his arm over my hair, to create static electricity that caused my hair to fly up, a phenomenon that he must have found interesting or perhaps amusing.

All three siamangs were fully developing their singing voices by this time, much to the chagrin of the resident orangutans. A nice, warm, late winter day outdoors warranted a hootenanny. Later the siamangs established a schedule of singing in the late morning and late afternoon, and their songs could be heard throughout large portions of the Zoo. Usually Zoli initiated the song, Sungai would add some bass tones, and Zain attempted to sing falsetto, but often failed, his voice ending in a kind of agonizing screechy warble.

The affiliations among the trio were unpredictable. Zoli and Zain often appeared to form an alliance against Sungai. For instance, on one occasion Sungai was hording peas that had been scattered on the floor. She threatened and attacked Zoli when he attempted to grab some of the peas. He cried out but stood his ground. She lunged again at Zoli and Zain jumped Sungai from behind. The two rolled around on the ground and Zoli leapt into the fray, two against one. Victorious in their conquest, the boys chased Sungai around the dayroom. By this time, Zoli and Zain frequently sported scabs on various parts of their bodies from these adversarial interactions.

On the other hand, Zoli and Zain were frequently seen in a bonding embrace, though if Zain decided to include hip thrusts, Zoli would pull away. Yet one day the three siamangs were observed in an all-inclusive bonding event. First Zoli and Zain performed their bonding hug, then Zoli swung over to Sungai and they embraced. Finally Sungai swung over to Zain, and they hugged. All in all it was a very dynamic interaction.

Year Five

I was away from the Zoo for nine weeks at the beginning of the fifth year of my interactions with the siamangs. While I was gone, only a few staff members went into enclosures with the siamangs. Staff had been dealing with some adverse behaviors by the siamangs, whose very large and sharp adult canine teeth had erupted. The area supervisor decided that due to the siamangs' surging hormones (they were beginning to exude an unmistakable musky odor) and erupting adult teeth, staff would no longer enter enclosures with the siamangs. However, she permitted me one last farewell visit, but stipulated that she would accompany me to thwart any adverse behaviors in the event that the siamangs became aggressive. When we entered the dayroom, the siamangs were very vocal and excited, hooting and zooming around the dayroom. When it appeared that the siamangs were behaving themselves, the supervisor left the enclosure. The siamangs immediately quieted down. Zoli swung over and hugged my head. Each siamang solicited snuggles and tickles. Finally, Zoli perched on my shoulder while Zain clung to me and settled onto my left hip. Sungai then approached and settled onto my right hip, placing her arms around me. We stayed in that position for the remainder of my visit. It doesn't get much better than that.

From then on, I only interacted with the siamangs through mesh. Zoli was quick to solicit backrubs, and was unwilling to share my attention. If Zain approached, Zoli leaned over and yanked on a hunk of hair on Zain's head while open-mouth displaying. Zain would leave, and Zoli would once again have his private massage.

All siamangs had been involved in operant conditioning training for some time. Periodically when I hand-fed diet to Zoli he would “perform” a training behavior (i.e., present ear) even though I never asked for a behavior. Because food had proved to be a catalyst for aggressive behavior and territorial sparring, the siamangs were separated whenever they were being fed. Because of this, I was able to engage in personal interactions with Zoli and Zain. If Zain was being well-behaved, I would give him a back scratch and perhaps hold his hand. Several times he “chee-cheed” at me and tried to hug me through the mesh. I would tell him I was sorry that we can’t hug anymore, but why don’t you go to Zoli, which he would do. They would embrace, a kind of hug by proxy. Zain finally figured out how to get an arm and a leg out of a space between the mesh and the concrete block wall, and he was able to grab my arm and hug me in that manner.

Besides soliciting back scratches and foot tickles, Zoli continued to spend time gazing directly into my eyes and once or twice stuck his hand out and placed it on my cheek while we “communed.” When I wore a particular shirt printed with small dragonflies, Zoli would try to pluck off the dragonflies and “eat” them, an innovative way of grooming me.

Sungai, however, was a different story. Once we no longer went into enclosures with the siamangs, Sungai became progressively hostile toward me. Since it wasn’t necessary that I participate in their care, I discontinued my customary visits with the siamangs.

And Beyond

I continued to see the siamangs if they were on exhibit when I walked around the Zoo. At first, they would acknowledge me and come over to visit. Eventually they would notice me but would stay together, as if they were consciously making the decision to stick with their clan.

However, six years after I last went in an enclosure with the siamangs, I was at the Zoo with a friend and we saw Zoli in an outdoor habitat. There was glass separating us. I mouthed his name and gestured for him to come over to us. He looked around, and then slowly made his way over to the glass. He swung over until he was hanging in front of me and once again gazed directly into my eyes with the same intensity as in the past. When a group of Zoo visitors came forward, Zoli turned away. I stepped back behind the group of people, but then Zoli turned back around and became very agitated when he did not see me, craning his neck to try to locate me. I moved so he could see me, he calmed down, and then after a few seconds he swung away. A few months later both Zoli and Zain were transferred to other zoos to be paired with females.

Afterward

Although this is a decidedly unscientific endeavor, I elected to chronicle my observations during surrogate care in hopes that they may someday inform and enlighten anyone tasked with the care of siamang or gibbon youngsters. It was my supreme joy and utter privilege to be included in this amazing process. I am profoundly grateful to the Louisville Zoological Garden staff for allowing me to participate in this incredible adventure.

Photos courtesy of LZG staff Jill Katka and Kara Bussabarger and the author.

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UPDATE!

All three siamangs are in bonded relationships with their designated mates and all three pairs have been observed breeding. Success!

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Building an On-Exhibit Training Square to Facilitate Successful Training of Somali Wild Ass (*Equus africanus somaliensis*)

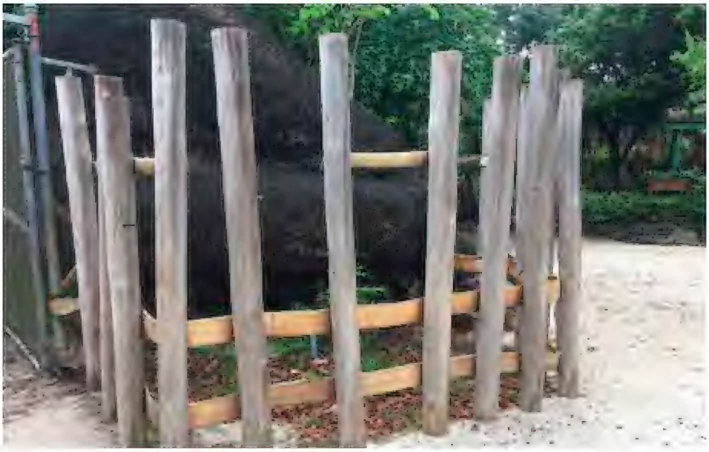
Emily Mack, Zoo Knoxville
Former Zoo Miami Keeper

Introduction

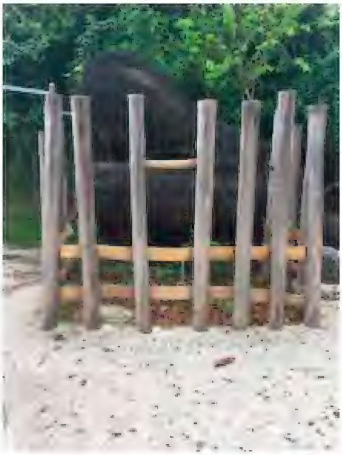
Zoo Miami houses 2.3 Somali wild ass (*Equus africanus somaliensis*). These animals are housed in two separate groups consisting of 1.3 (one juvenile male and three adult females) and 1.0 adult breeding male. 1.3 are housed on exhibit during the day and in open-air chain link holding pens at night. 1.0 is housed in the holding pens only and is shifted between holding pens for cleaning. This setup presents many challenges when training these animals towards behavioral goals. As a zookeeper in the area I designed and built a "training square" on exhibit in order to address these challenges. The training approaches to these two groups vary, and therefore the current set up presented different training challenges for both groups. 1.0 allows tactile interactions and has been trained on several behaviors through the chain link fence, including "target", "line up", hand injection, and picking up each of his four legs on command. 1.0 is worked only through protected contact because of his potential aggression when he is attempting to breed females. Before the training square was built, there was no way to train on exhibit in a protected contact setting. 1.3 are much more stand-offish and reluctant to approach keepers. They will not take rewards from trainers' hands. This group required a way for keepers to perform desensitization training with them with both free and protected contact set-ups.

The current environment presented many challenges when working with these animals toward training goals. The chain link fences enclosing the off exhibit holding pens have some gaps between the fence and the gates where keepers can reach the animal's body for injections, etc., but these gaps are narrow and make it hard to have much room to reach a larger body area or have a wide range of motion. Also, the animal must be lined up very precisely in the gaps for

Front of training square at an angle.



Front of training square.



their bodies to be accessible. There are no stalls, chute systems, or smaller areas to shift an animal into for more precise training to be accomplished. Keepers wanted to build a new training area, either on exhibit or in holding, in order to address these challenges. The challenges to overcome for this project included the fact that keepers would have to mostly build any new training area ourselves. Any training area would require keepers to be able to work protected contact while still being able to access any part of the animal's body for injections, hoof trims, etc. A new training area would need to have larger open areas in order to solve these problems. Because Zoo Miami is in Florida, all of the exhibits and off-exhibit holding areas are open air, so any training area would be exposed to the elements. This would include rain, heat, humidity, and potential hurricanes, so the materials used for the training square would need to withstand these weather conditions.

When I started, keepers began brainstorming several options for a training wall set-up in the Somali wild ass area. Plans were designed for both inside the off-exhibit holding pens and for outside on exhibit. The final plan was submitted in November 2016 for a training square on exhibit, built using eucalyptus poles and fire hose. The training square was completed in January 2017 and has been in use almost every day since. The construction and building process were as follows:

Construction Method

Materials used:

1. twelve eucalyptus poles (six inches in diameter, eight feet tall)
2. firehose
3. four inch screws with large washers

To do list:

1. The area on exhibit where the poles would be placed was measured out and marked. The plan originally called for fourteen poles, but twelve poles fit better into the space.
2. Dig holes and sink poles. A nine-inch auger was used to dig the holes two feet deep so that the poles would have a one foot wide gap in between them. The poles were sunk two feet into the ground so that they would stay sturdy. This resulted in six feet of the poles standing vertically above the ground.
3. Secure the poles. Concrete was added to some holes as needed to keep them in place. Dirt was placed back into the holes and packed around the poles so that they would stay upright. These poles have stayed in place even through a Category Three hurricane.

Modifications:

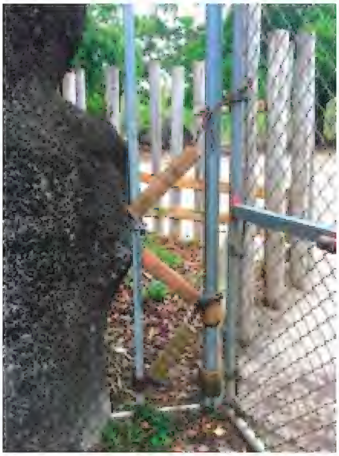
After these poles were put into position and the Somali wild ass had been on exhibit with them for a few weeks, the animals started pushing through a few wider gaps between the poles. Some poles started to lean so that they were no longer upright. To address this problem, keepers installed two strands of firehose running horizontally on the inside of the training square. One strand ran three feet and one strand ran one and a half feet above the ground. The holes for the screws were measured and pre-drilled in the poles and in the firehose, then screws with washers were used to secure the firehose in place. These strands of firehose have also stayed in place through a Category Three hurricane and stopped the Somali wild ass from pushing into the training square. One pole was removed from the existing fence next to the exhibit gate so that keepers could access the training square.

Usage

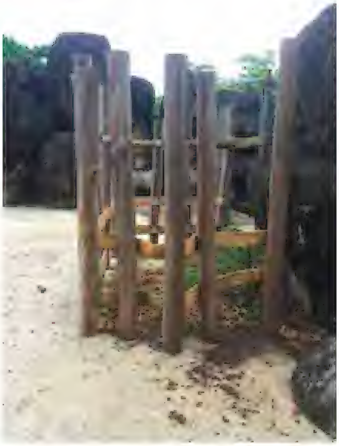
The set-up of the training square helped to address many of the challenges keepers faced when trying to train in the old holding set-up. Zoo Miami employs two training and enrichment curators who started at the zoo after the training square was built. Keepers consulted with these curators and with consultants from Precision Behavior in order to improve the ways in which keepers could use the holding and exhibit set-up to accomplish training goals.

Training 1.0 with protected contact was very difficult while he was housed in the holding pens and was impossible while he was on exhibit. Before the training square was built, keepers attempted to use a firehose strap between two of the chain-link gates in the holding pens. This firehose strap set-up consisted of two straps crossing at knee- and shoulder-height of the animal and a strap crossing

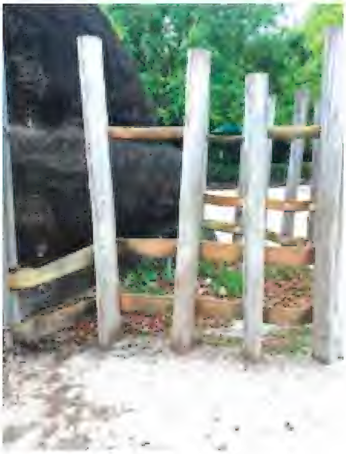
Keeper entrance to training square.

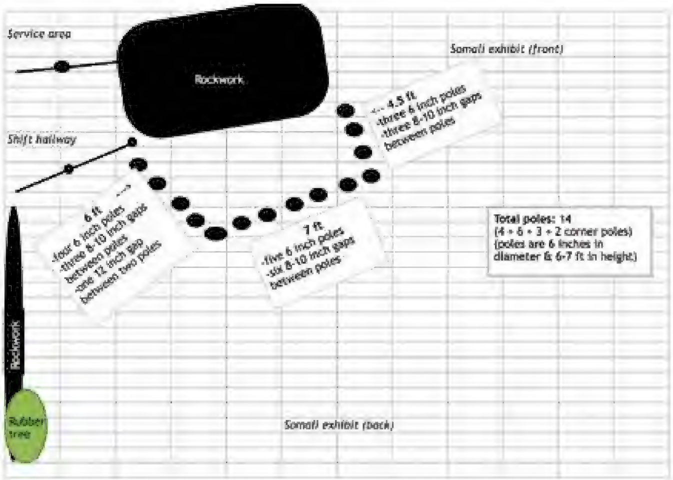


Right side of training square.



Side of training square.




Service area
Rockwork
Somali exhibit (front)
<-- 4.5 ft
-three 6 inch poles
-three 8-10 inch gaps between poles
Shift hallway
-->
6 ft
-four 6 inch poles
-three 8-10 inch gaps between poles
-one 12 inch gap between two poles
7 ft
-five 6 inch poles
-six 8-10 inch gaps between poles
Total poles: 14
(4 + 6 + 3 + 2 corner poles)
(poles are 6 inches in diameter & 6-7 ft in height)
Rockwork
Rubber tree
Somali exhibit (back)

above his head. However, keepers could not find a way to safely train behaviors. The training square solved this problem by allowing keepers to go "on exhibit" while 1.0 is on exhibit without having to shift him into the holding pens. The training square also has larger openings than the gaps which are in the chain-link fence of the holding pens. These larger openings allow keepers to make 1.0's behaviors more reliable and to work toward the ultimate goal of each behavior, including the ability to perform voluntary hoof trims. The training process is also much faster with the training square than it would have been with the previous arrangement.

While 1.3 are housed together on exhibit, keepers can use the training square to train them at any time of the day. 0.3 are still very wary of approaching people, so keepers perform desensitization training using their grain multiple times a day without removing animals from exhibit. Keepers also attempted to desensitize 0.3 to hanging feeders on the chain-link fence of the holding pens when they were off-exhibit, but ran into challenges as it was not easy to deliver grain to the feeders through the fencing material. The training square helps overcome this obstacle as it is much easier to deliver grain to the feeders on exhibit through the holes between the poles of the training square. It is hoped that the training square will improve the keepers' ability to desensitize all of the animals, including the juvenile male, to the presence of trainers.

Conclusion

Building the training square helped to solve multiple training and management challenges which faced the keepers in working with the Somali wild ass. The set-up of the exhibit and off-exhibit holding area do not allow for easy access to training while animals are on exhibit and does not offer a flexible training set-up using protected contact. The training square solves these problems by offering a place where keepers can go on exhibit with animals to train in a protected contact setting. The training square has allowed training objectives to be accomplished much more quickly. This also allows animals to remain on exhibit where visitors can view them, and this offers a future opportunity to do visitor outreach through training and interpretive demonstrations. The injection and hoof trim training will improve future animal welfare by allowing animals to be hand-injected and to have their hooves worked on without requiring the use of anesthesia. This reduces stress on animals and keepers by eliminating the need for a dart gun. It also reduces the number of immobilizations required if keepers can maintain good animal hoof health through routine trims. The use of the training square has helped to promote keeper safety, achieve training goals, and improve animal welfare.

Emily Mack is now a keeper at Zoo Knoxville, TN.

BEHAVIORAL HUSBANDRY COMMITTEE

Comments by Jay Pratte:

Over the years BHC members have taught at workshops and published papers focusing on thinking creatively about your environment, illustrating how trainers can shape existing areas/ structures to help meet behavioral goals. This Tale provides us with an example of how, with basic materials, some effort and time, that extra funding or work orders are not necessary to achieve an end. Here, existing structures and spaces were modified in ways to provide access to the animals in a protected contact setting, allowing training, enrichment or other keeper interactions to occur safely at any time of the day. Many of us struggle with the desire to attain a behavioral goal and feel frustrated by lack of budget, assistance, maintenance staff, etc. It may be that a simple, direct solution is fully within your control, and permit more influence over the antecedents for training sessions.

This type of training area also allows for dynamic keeper talks/ demonstrations about training and everything that we do in our jobs. It also now provides a safe VIP or behind-the-scenes area to again showcase not only the hard work invested but provides the zoo with an opportunity to educate guests and even potentially generate revenue (i.e., paid BTS encounters that are becoming more prevalent). Great job, and always keep your eyes open for ways you can shape your environment for success!

Thank you for your Training Tale submission.

Everybody In! Tracking Eastern Box Turtles at the Maryland Zoo in Baltimore

Katharine Mantzouris, Hospital & Conservation Programs Coordinator
The Maryland Zoo in Baltimore
Baltimore, Maryland

Introduction

The Maryland Zoo in Baltimore has been tracking free-range Eastern box turtles *(Terrapene carolina carolina)*, on zoo property since 1996. The early stages of the project were led by a local university, in which researchers brought students on-grounds to conduct transect surveys and radio-tracking. In 2001, the project was taken over by the Maryland Zoo in which turtles were exclusively tracked through incidental encounters. Although this sampling method required minimal staff time and resources and was, therefore, able to continue for 20 plus years, it provided limited results about the local box turtle population. For example, this data does not tell us if the years in which just one or two incidental encounters were reported were from a declining box turtle population or due to low participation or unawareness of the project from staff.

The Maryland Zoo has been working on conservation and research projects for decades, however, in 2017 a formal Conservation Department was formed and with that, a revitalization of the box turtle project began. The project, under the direction of the new department, was rebranded as "The Maryland Zoo Box Turtle Monitoring and Citizen Science Project." Steps were taken to increase awareness of the project to all zoo staff and volunteers including the distribution of informational posters and regular updates on the project at zoo-wide staff meetings. This greater awareness led to an increase in participation from staff members and volunteers who were instructed to report a box turtle sighting if one is seen during their shift to the appropriate project staff.

Method

Once increased awareness and participation in the incidental findings of box turtles were established, we took additional steps in our research and education. Soon, it became apparent we needed radio-telemetry equipment to further this project. In 2018 we were the recipients of AAZK's Conservation, Preservation and Restoration Grant in which we received reimbursement for purchasing a radio antenna and receiver. Our main goals upon receiving this equipment were:

1. To begin tracking box turtles that live on zoo-grounds and the surrounding Druid Hill Park area and develop research questions in congruence with incidental encounters.
2. Use our radio telemetry equipment as an education tool with fellow staff and volunteers.
3. Use our radio telemetry equipment as a citizen science project for our committed Zoo Teen Volunteers.

Mid-summer 2018 through 2019 served as a pilot phase, which gave project leaders the chance to fit turtles with transmitters and hone their technical skills using the radio telemetry equipment. After receiving the grant, an unexpected but good opportunity presented itself to begin tracking turtles and learning how to use our new equipment. Namely, in June of 2018, the Zoo received two box turtles of unknown origins that were dropped off by a member of the public. Due to the unknown origin of these turtles, and our desire to have them return to the wild, the zoo conducted medical examination and disease screening and with permission from the Maryland Department of Natural Resources, released them onto zoo grounds fitted with radio-transmitters. (Figure 1).We began monitoring their movements and survival a month after receiving them.

Maryland Zoo Reptile and Amphibian Collection and Conservation Manager, Kevin Barrett was the first staff member trained on this equipment, followed by Maryland Wilderness Area Manager Danielle Regan and point person of the box turtle project, Kat Mantzouris. Soon, all six Animal Keepers of the Maryland Wilderness Team began training on the equipment and began taking Animal Department college interns out for demonstrations and tracking.

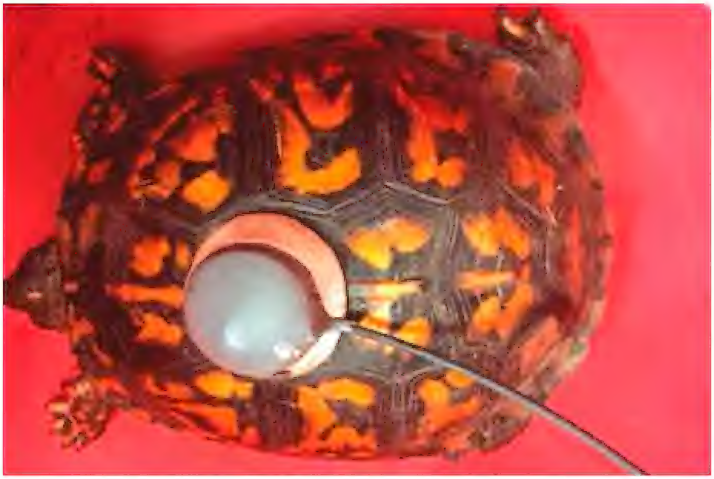
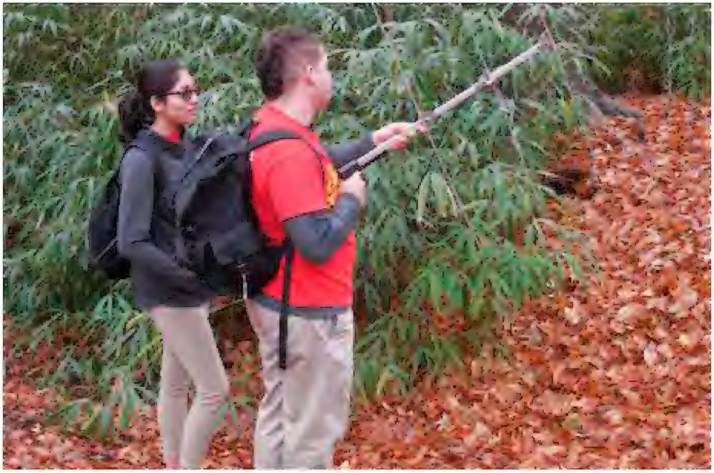


Figure 1. Eastern box turtle fitted with a radio-transmitter.

The Maryland Zoo has a high-school-aged volunteer and leadership program called Zoo Teen Volunteers. This program allows teenagers interested in science and the environment to volunteer at the zoo and receive hands-on experience with education, research, and conservation. In December 2018, Zoo Teen Volunteers were taken out for box turtle tracking for the first time. The Teen Volunteers tracked one of the turtles and marked where it had begun brumating for the winter. Learning to use radio-telemetry requires concentration and one-on-one usage with the equipment and, therefore, limiting the number of people that can go out tracking at once. To work around this issue, we first trained a small, core group of the teens, and then those teens were paired-up with newcomers to train on the equipment. Between May and July 2019, four Eastern box turtles were found during surveys and were fitted with radio transmitters. In 2019, our first full season of tracking, six turtles were tracked and found 40 times over

Figure 2. Zoo Teens tracking Eastern box turtles.


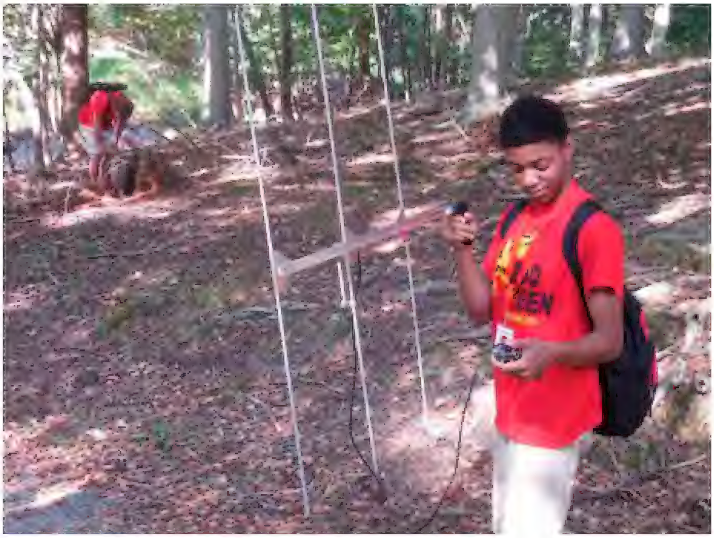


FIgure 3. Zoo Teens tracking Eastern box turtles.

19 days throughout the year. A total of 14 Zoo Teens became "regular trackers" while 47 Zoo Teens had at least a one-time tracking experience (Figures 2 & 3). Additionally, staff members from the Animal, Volunteer, Hospital, Marketing and, Education Departments participated in these tracking sessions with some mastering the equipment.

Findings

In the beginning, one of the first two turtles to receive a radio-transmitter traveled in a way that is somewhat predictable for a translocated box turtle, according to available scientific literature. This turtle was placed in an area of the zoo that is known for box turtles to thrive but traveled approximately a half a kilometer, breaching at least one perimeter fence and found its way on top of a retainer wall for Baltimore's Light Rail tracks. The turtle was retrieved from this dangerous area and released in the same ideal habitat. The turtle then moved around in the "ideal habitat" for a few weeks and then settled into a bamboo patch for brumation. The following season this turtle wandered much less, although it did travel a few fence lines, and then settled into a wooded area adjacent to zoo-grounds for brumating for the second time.

Additionally, a female turtle that was fitted in 2019 with a radio-transmitter and presumed to be a resident box turtle in the area moved relatively far in a short amount of time as well. The female was tracked five times over the course of four and a half months and was found traveling an average of 160 meters between each tracking, with the furthest distance being 350 meters. This behavior of traveling, along with the anecdotal observation of leaving relatively quiet and undisturbed forest areas to cross zoo roads and go to more developed areas has led to more questions to work toward answering for our 2020 box turtle tracking season.

Conclusion/Next Steps

Looking ahead to 2020, we are moving beyond just tracking and into forming a comparative research question that could lead to publication. The first step in this began by holding a Zoo Teens Box Turtle Workshop on February 9, 2020. This workshop was designed to give the Teen Volunteers experience and insight into the process of formulating a research question and designing its study. Having a real-world project to discuss that the Zoo Teens participate in led to rich discussions and exercises during the workshop. In exchange, the Box Turtle Project received ideas to give the project more purpose and direction (Figure 4).

A new season of tracking turtles in and around the Maryland Zoo campus will begin this spring. Our research question will be looking at site selection preferences in adult box turtles and how the box turtles navigate around human development.

The telemetry equipment, provided by AAZK, has been an essential part of taking Maryland Zoo's Box Turtle project to the next level in research and conservation. Additionally, it has provided a valuable teaching opportunity to fellow staff members, volunteers, and our enthusiastic group of Zoo Teens.

Figure 4. Zoo Teens exchanging ideas during a Box Turtle Project workshop.

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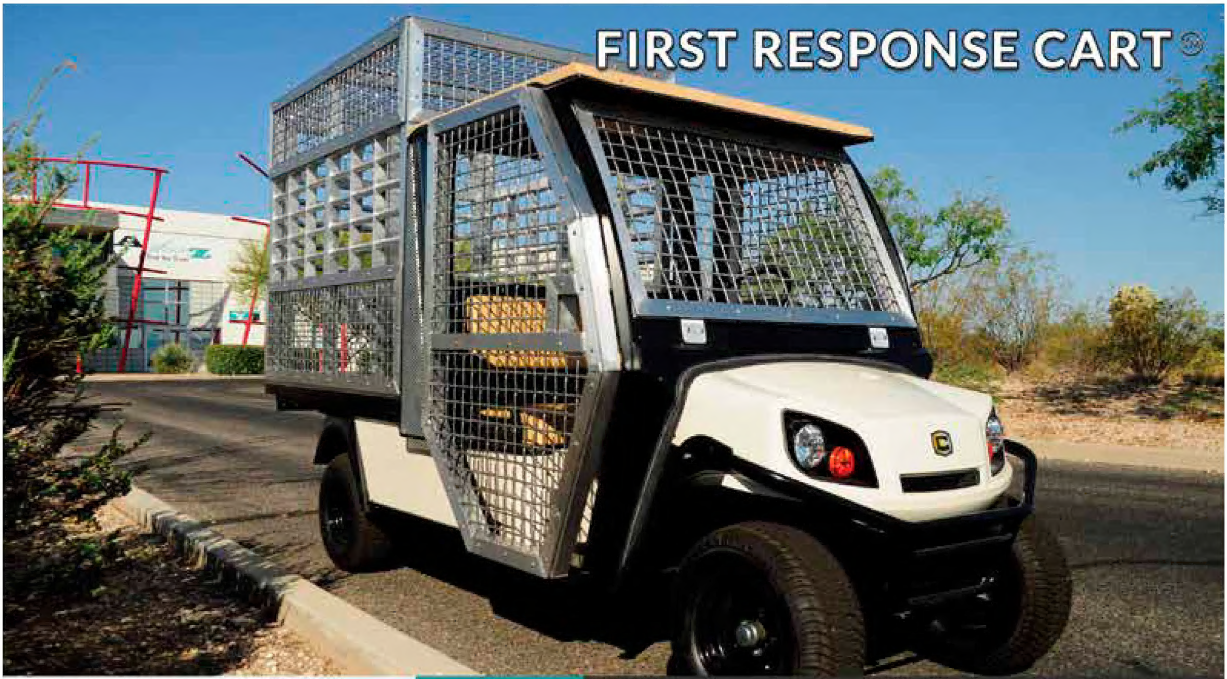

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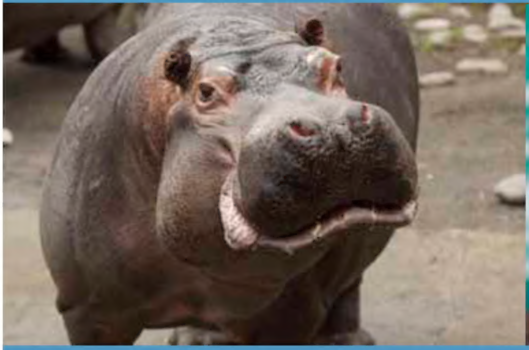

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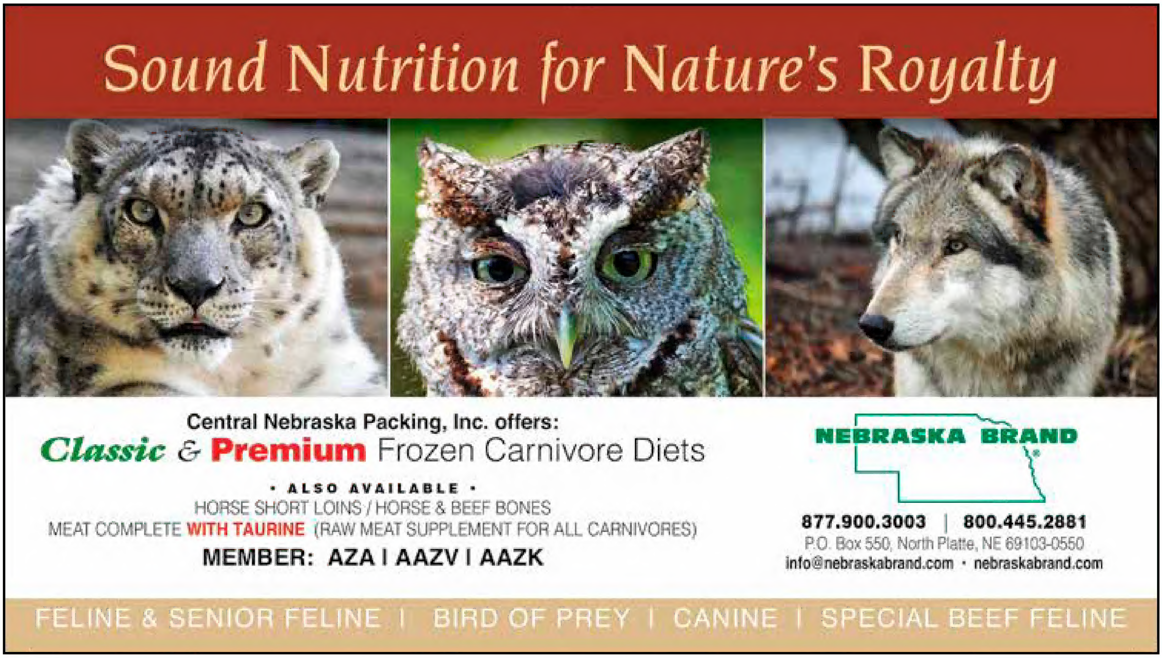
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